# Regulated Phase Transitions of Bacterial Chromatin: a Non-Enzymatic Pathway for Generic DNA Protection

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Abstract No. fren4076
Beamline(s): **X12B**

**Introduction**: The enhanced stress resistance exhibited by starved bacteria represents a central facet of virulence since nutrient depletion is regularly encountered by pathogens in their natural *in vivo* and *ex vivo* environments. We show using electron microscopy and X-ray scattering from intact cells that survival of bacteria in nutrient-depleted habitats is promoted by the appearance of a highly ordered DNA/protein assembly. Since this physical mode of defense is independent of enzymatic activity as well as of *de novo* protein synthesis, it promotes virulence by enabling long-term bacterial endurance and enhancing antibiotic resistance in adverse habitats.

**Methods and Materials**: X-ray scattering measurements from intact cells were as follows. Specimens consisted of *E. coli* bacterial pellets prepared from 3 ml cultures and treated with 2% glutaraldehyde in 0.1M sodium cacodylate buffer ( pH 7.4) at room temperature in order to reduce radiation damage. 2 or 3 independently prepared samples of each category were examined. A multi-wire position sensitive detector was used for data acquisition. Background subtraction and cylindrical averaging of the two-dimensional data about the pattern center were accomplished using software written by M. Capel.

**Results and Conclusions**: X-ray patterns from starved wild-type bacteria exhibit two main features: a peak at 9.4 nm and a superimposed doublet at 4.9nm and 4.7nm. On the basis of these data, which are supported by electron microscopy results, a model has been presented which proposes stacked alternating layers of DNA and protein molecules, in which the DNA is sequestered and protected from host attack.

**Acknowledgements**: This work was supported in part by the Israel Science Foundation and by the Minerva Foundation (Germany).

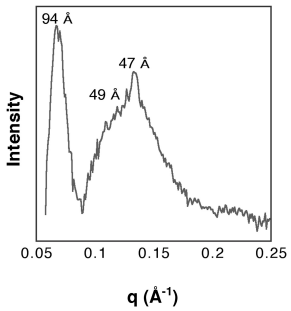


**Figure 1**. X-ray scattering pattern from intact wild type *E. coli* presented as a difference profile that is obtained by subtracting the scattering curve of midlogarithmic phase bacteria, in which no bands are discerned, from the scattering curve of *E. coli* cells, incubated for 48 h, following the onset of stationary phase